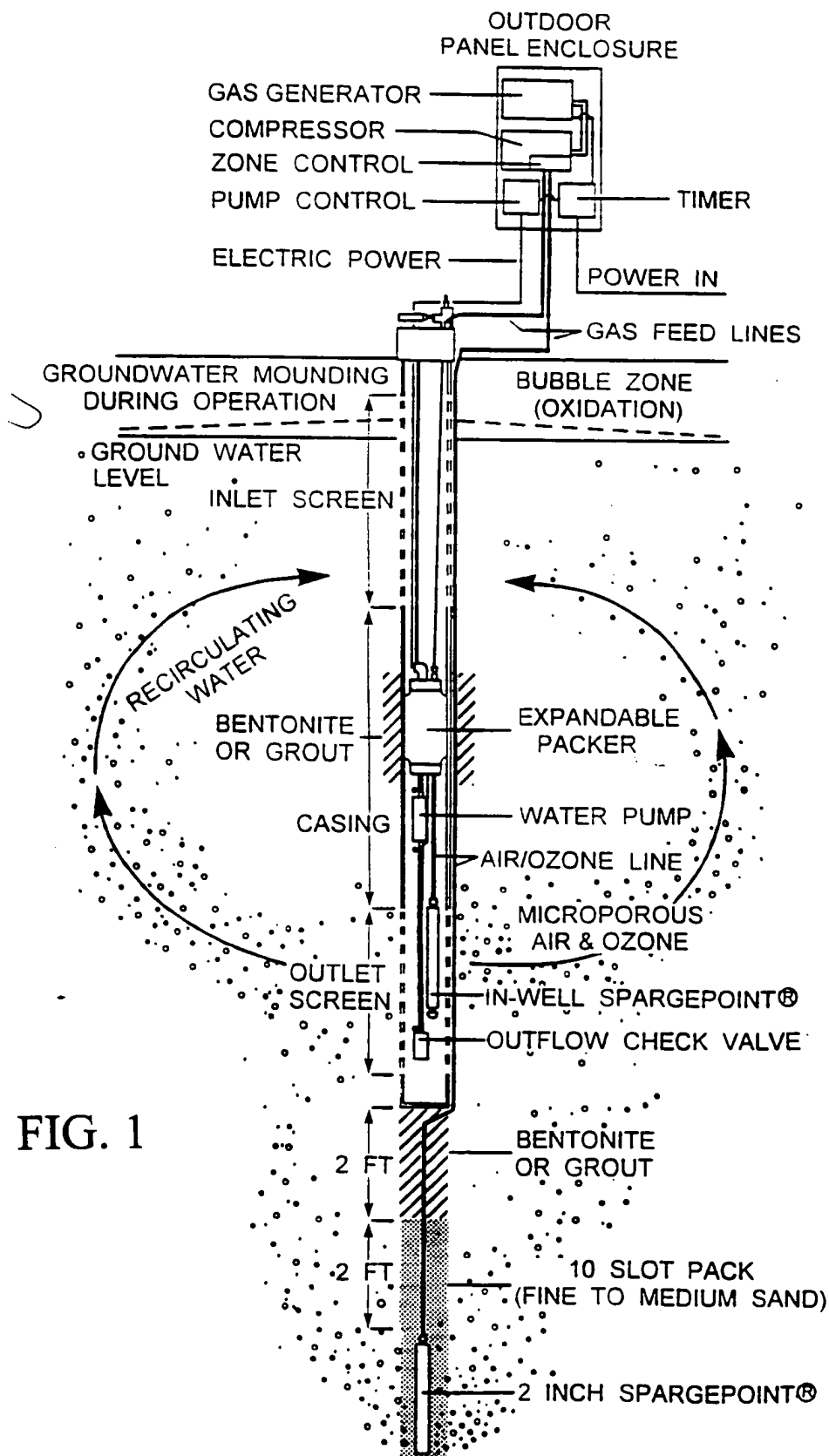


0953150 110601



A schematic diagram of a groundwater remediation system. At the top, a rectangular box represents the surface equipment. Inside this box, from top to bottom, are: 'AIR OR OXYGEN IN' (with a downward arrow), 'OZONE GENERATOR', 'COMPRESSOR', 'OTHER WELLS' (with two downward arrows), and 'PROGRAMMABLE VALVES'. To the left of the box, 'CONTROL MODULE' has an arrow pointing into the box, and 'AIR IN' has an arrow pointing into the 'COMPRESSOR' section. Below the box, a vertical well casing is shown. Two gas lines enter the casing from the left: 'GAS LINE TO TOP ZONE' and 'GAS LINE TO BOTTOM ZONE'. The well casing has an 'UPPER WELL SCREEN' and a 'LOWER WELL SCREEN'. A dashed horizontal line indicates the 'TOP OF GROUNDWATER (CONTAMINATED)'. Inside the well, there is a 'FIXED PACKER (REMOVABLE CLOSURE PLUG)' and a 'FINE BUBBLE PRODUCTION CHAMBER'. Below the chamber is a 'PUMP' and a 'CHECK VALVE'. At the very bottom of the well is a 'PLUG' and a 'BOTTOM SPARGEPOINT'. Arrows indicate 'WATER FLOW' upwards from the lower screen and 'WATER' entering the chamber from the top. The diagram uses dots to represent contaminated groundwater and bubbles to represent gas being injected.

FIG. 2

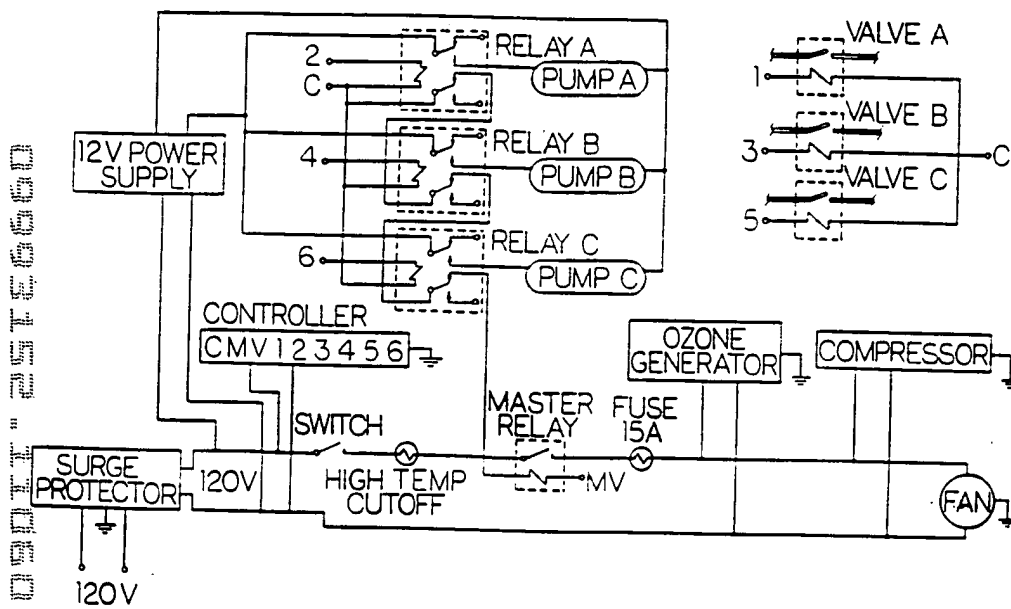


FIG. 3

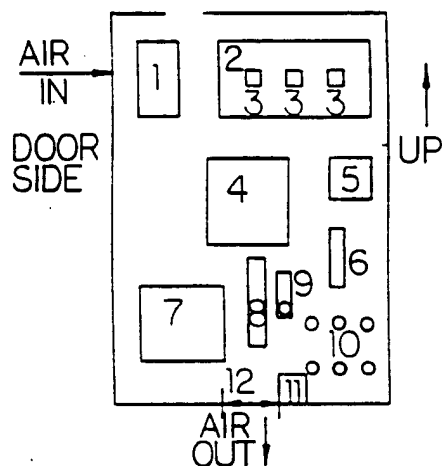


FIG. 4

- 1 AC TO DC POWER CONVERTER (OR TRICKLE CHARGED LEAD ACID BATTERY)
- 2 OZONE GENERATOR
- 3 WELL GAS RELAYS (3 WELLS SHOWN)
- 4 COMPRESSOR
- 5 MASTER RELAY
- 6 15A MAIN FUSE
- 7 PROGRAMMABLE TIMER-CONTROLLER
- 8-POWER STRIP
- 9 GAS REGULATOR AND PRESSURE GAGE
- 10 SOLENOID MANIFOLD (NUMBER DEPENDS ON SERIES AND NUMBER WELLS)
- 11 GROUND FAULT INTERRUPTOR
- 12 COOLING FAN

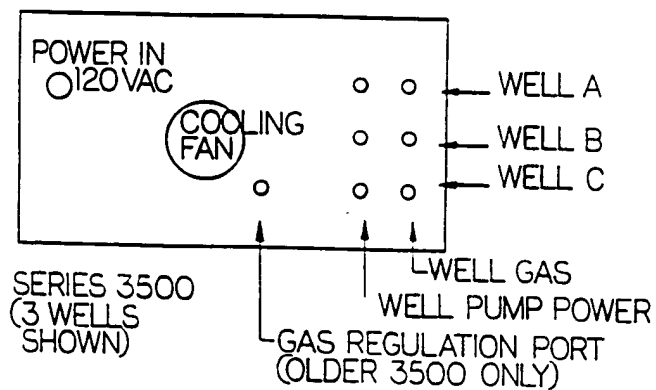


FIG. 5A

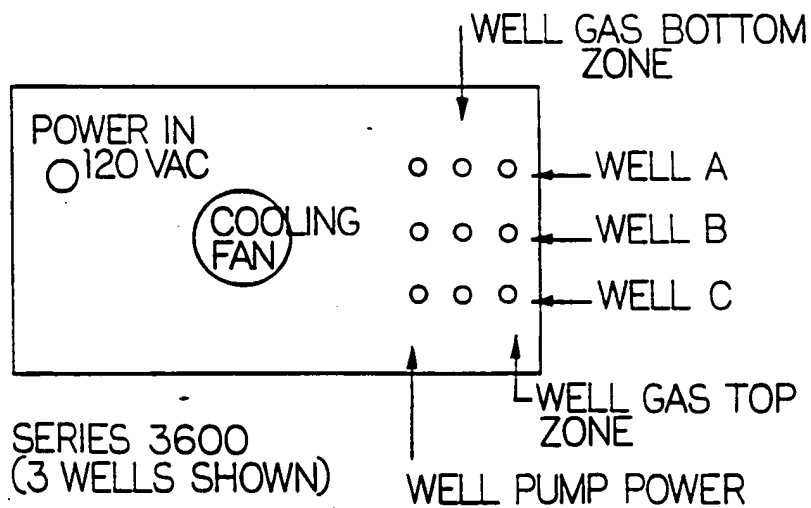


FIG. 5B

FIG. 5A

A schematic diagram of a groundwater monitoring system. At the top left, a house icon is labeled "120 VAC POWER". A line connects it to a "CONTROL MODULE" (a small box with wires) located near the surface of "WELL A". Three vertical lines represent "WELL A", "WELL B", and "WELL C" extending into an elliptical area representing the ground. Inside this area, several 'x' marks are labeled "MONITORING WELLS". Arrows point from the monitoring wells towards the right, labeled "GROUNDWATER FLOW". An arrow labeled "CONTAMINATED GROUNDWATER" points from the left towards the wells.



0953152-140601

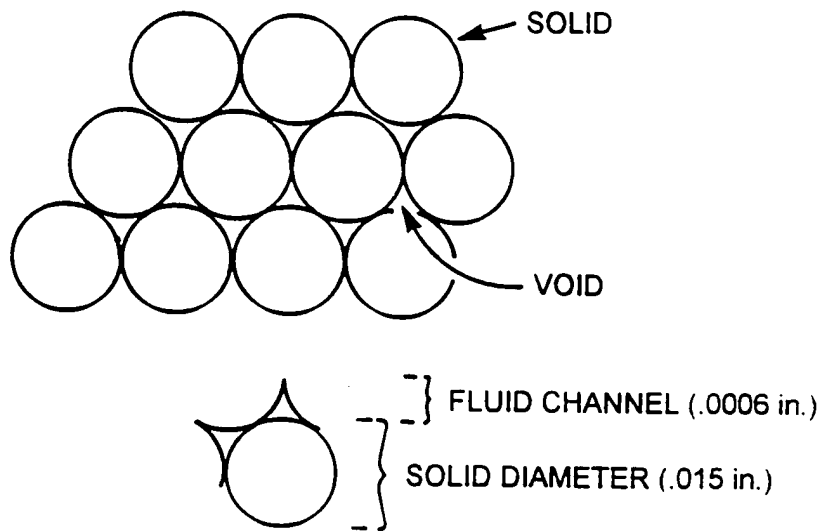
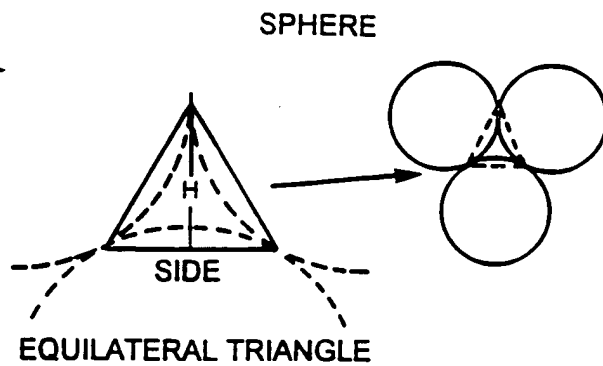
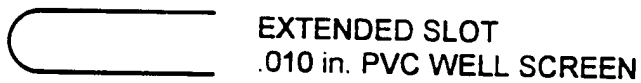
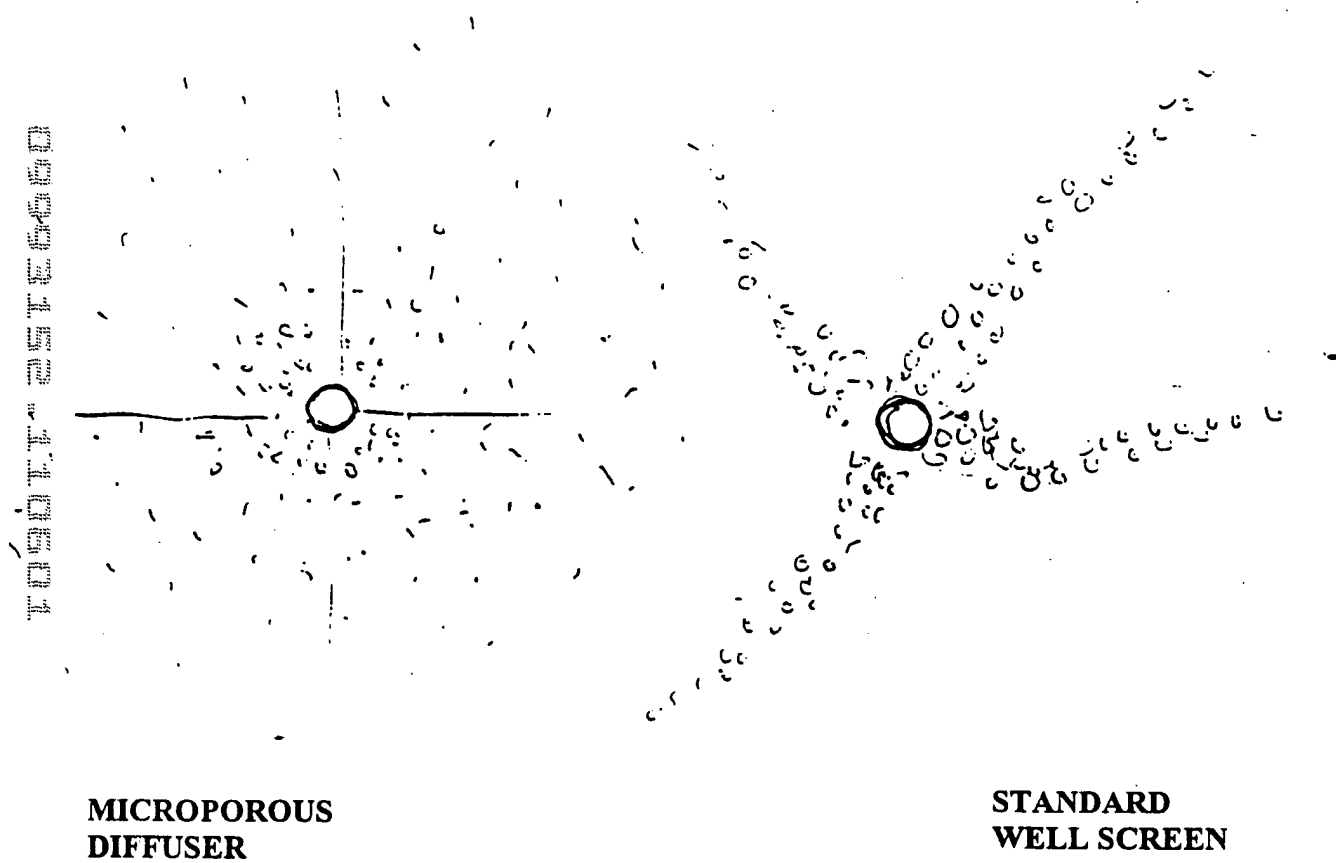


FIG. 7





Permeability of Glass Beads Compared
with Permeability of Soil Fractions

Mean Bead Diameter (mm)	Pore Space (microns)	Permeability (Darcy)	Gas Conductivity (cm/sec)	Equivalent Soil Classification
2.000	860	1000	1.000	Very coarse sand
1.200	516	250	0.250	Coarse sand
0.655	281	147	0.147	Medium coarse sand
0.327	140	85	0.085	Medium sand
0.167	72	22	0.022	Fine-medium sand
0.083	36	9	0.009	Fine sand
0.041	18	5	0.005	Very fine sand
0.020	9	2	0.002	Very fine silty sand

Modified from Anderson, et.al., 1987²

FIG. 9

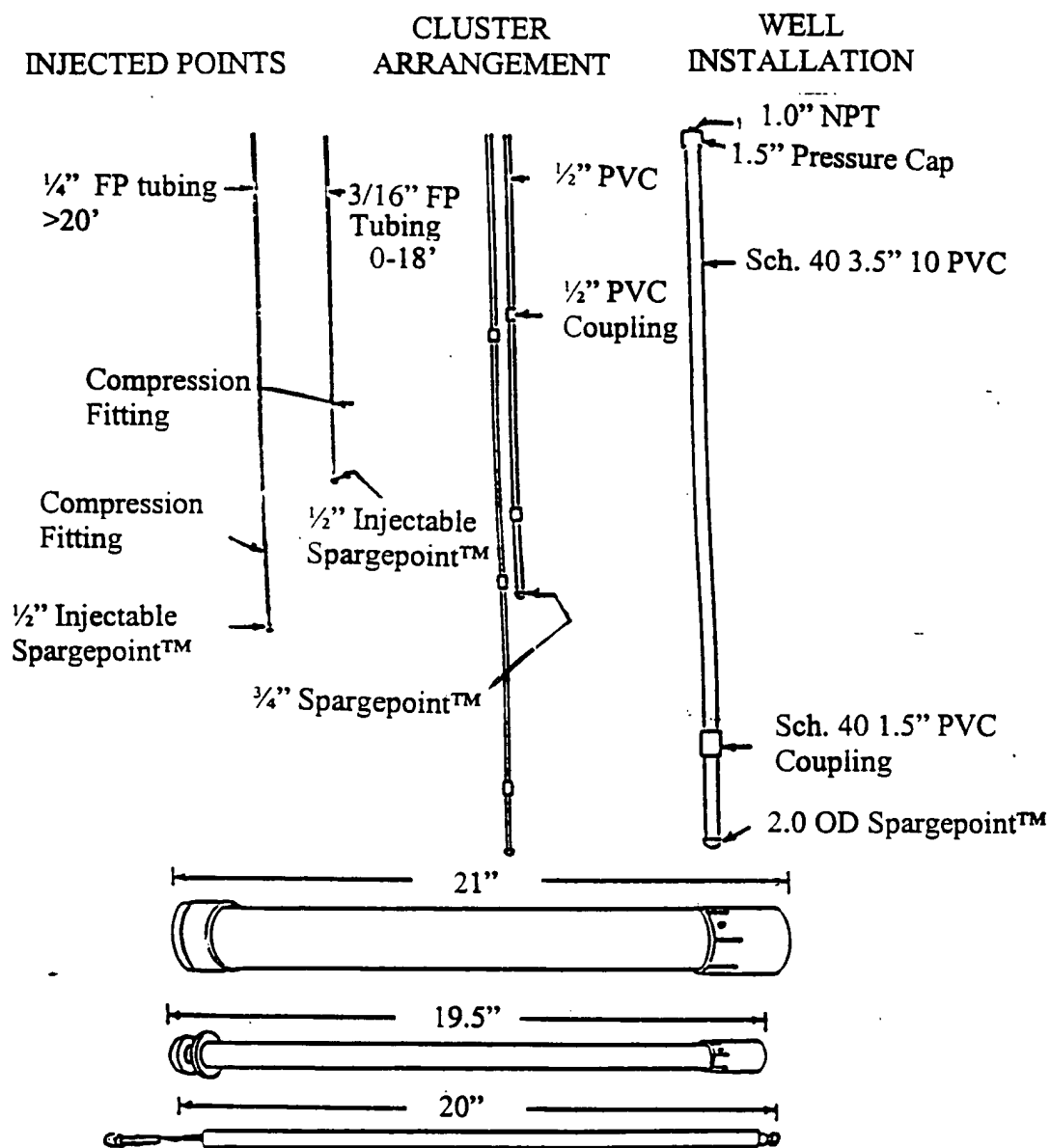


FIG. 10

0950153-10501

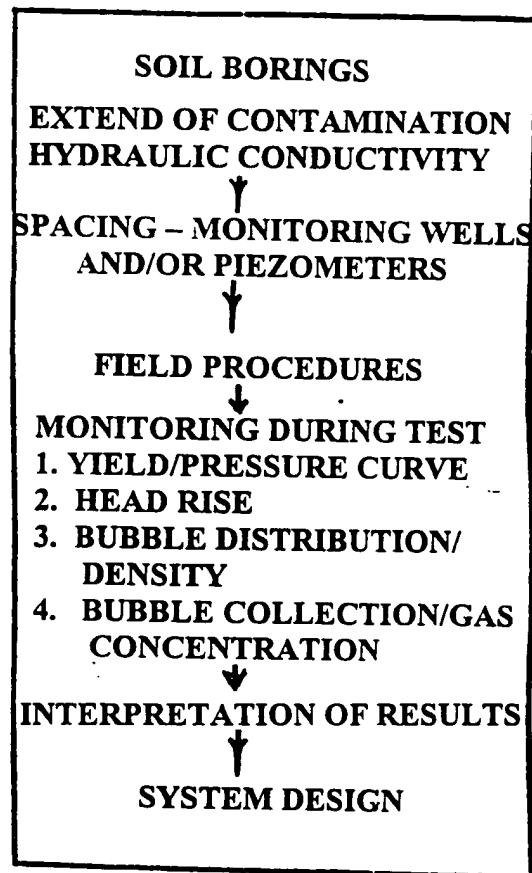


FIG. 11

SPARGEPOINTTM TEST ASSEMBLY
 1/2" OR 3/4" POINT WITH 1 INCH CASING

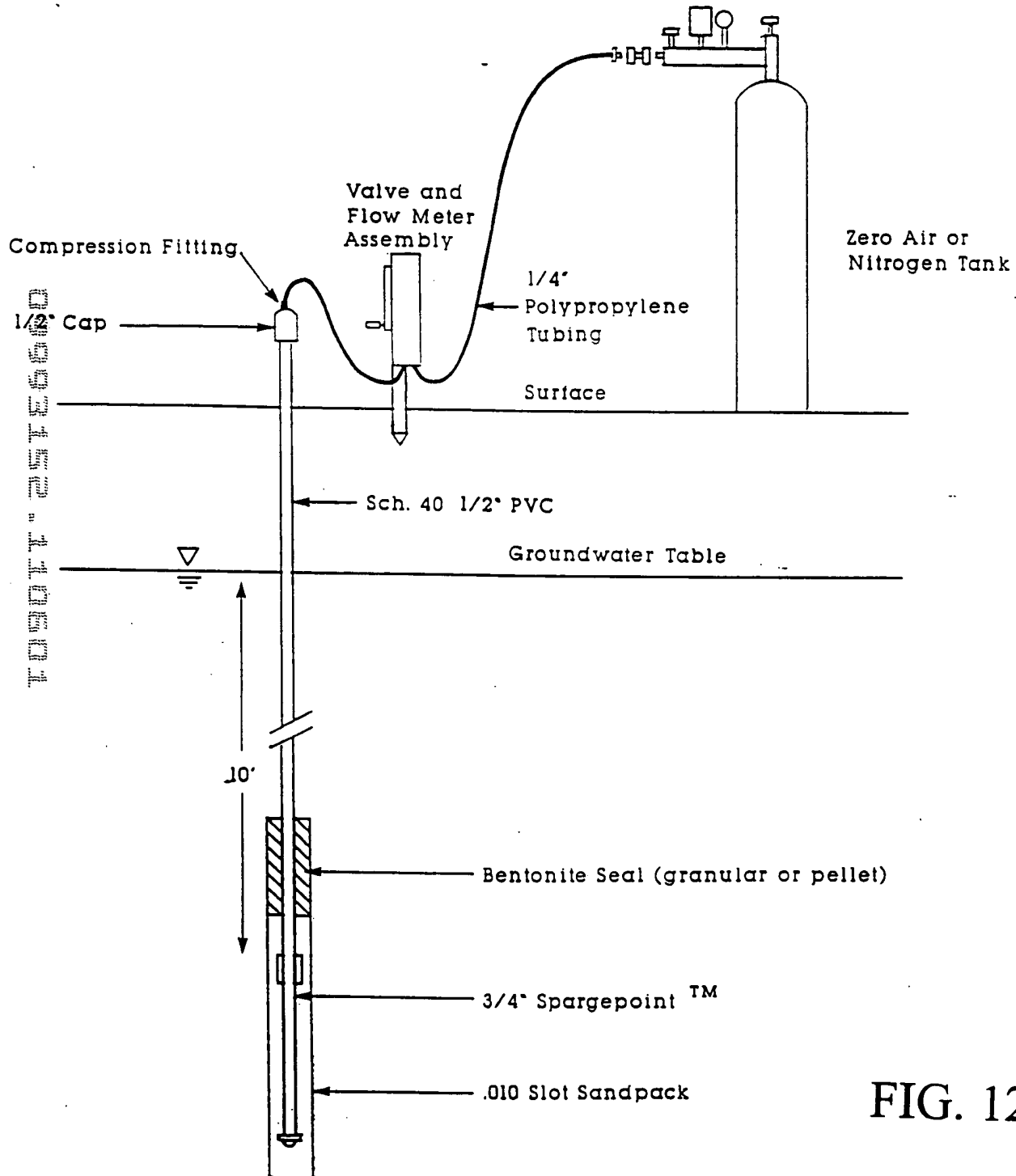


FIG. 12

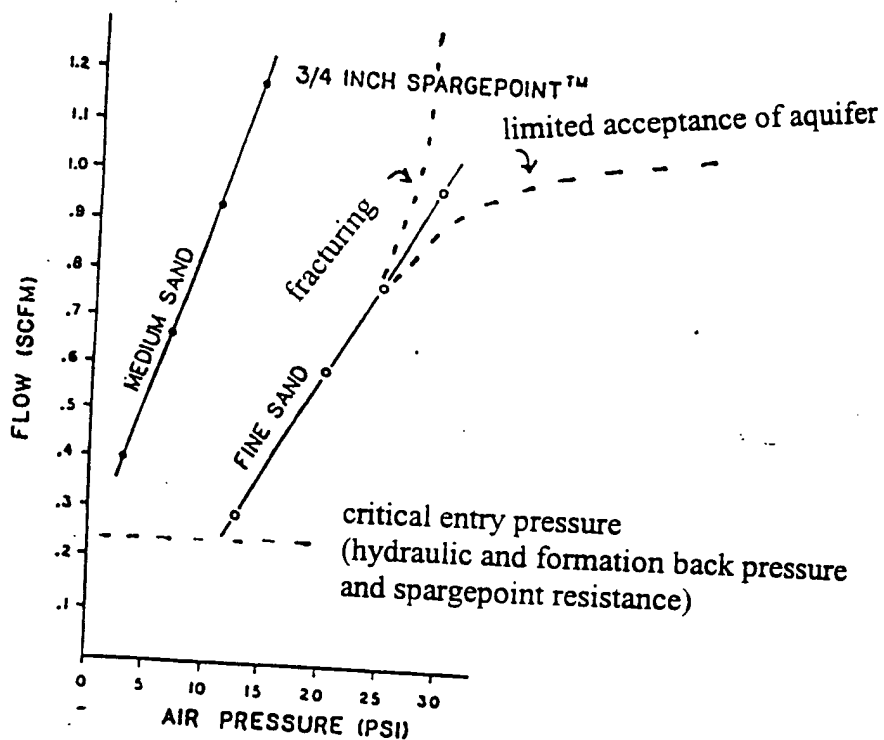


FIG. 13

INFLUENCE OF DEPTH AND PRESSURE ON RADIUS OF BUBBLE ZONE

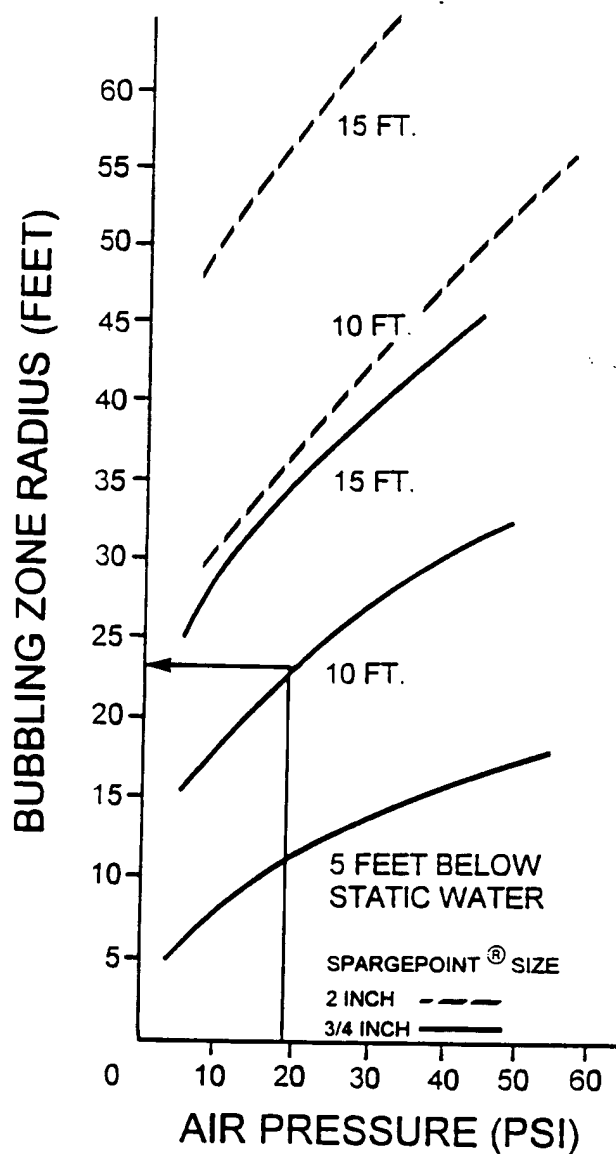


FIG. 14

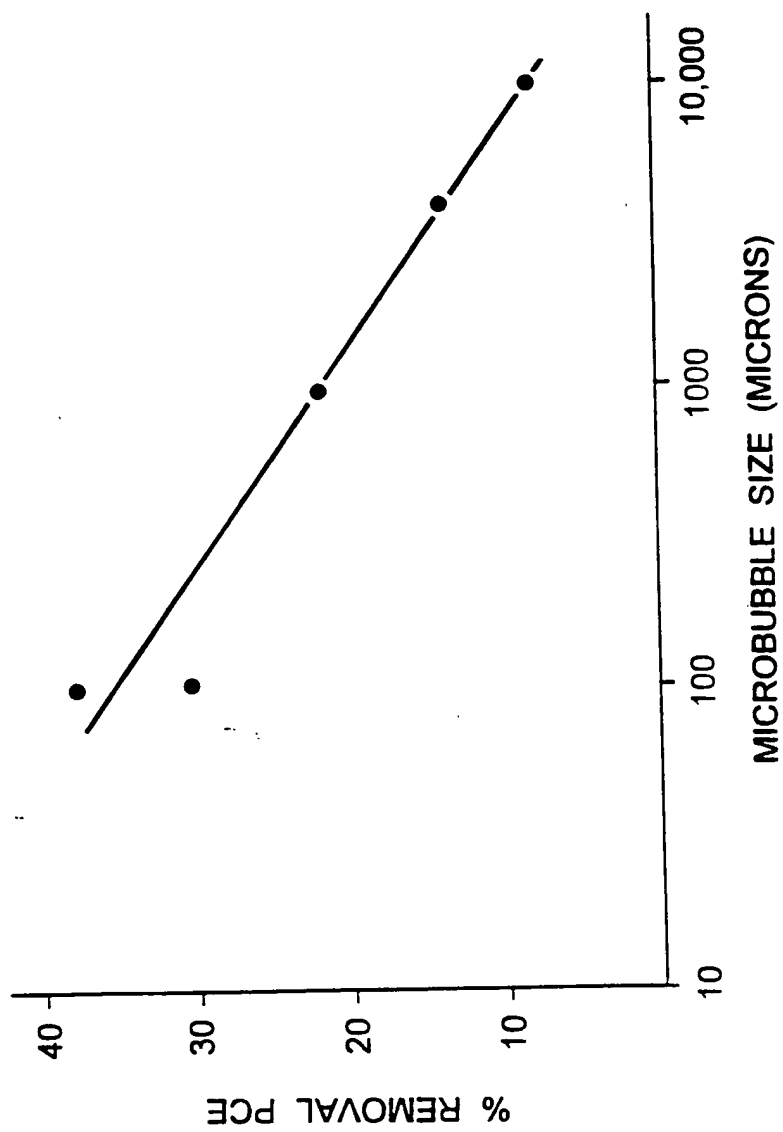


FIG. 15

0993153-110601

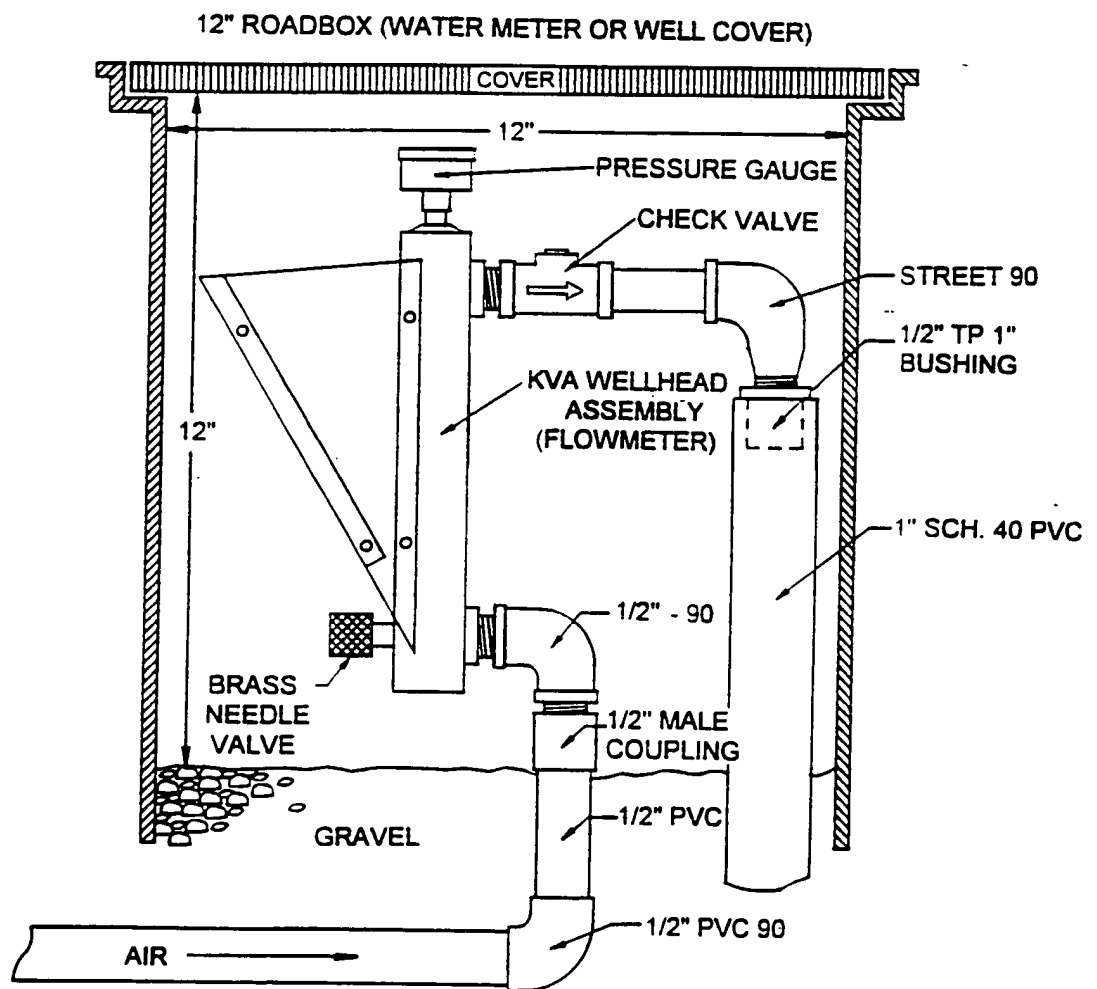
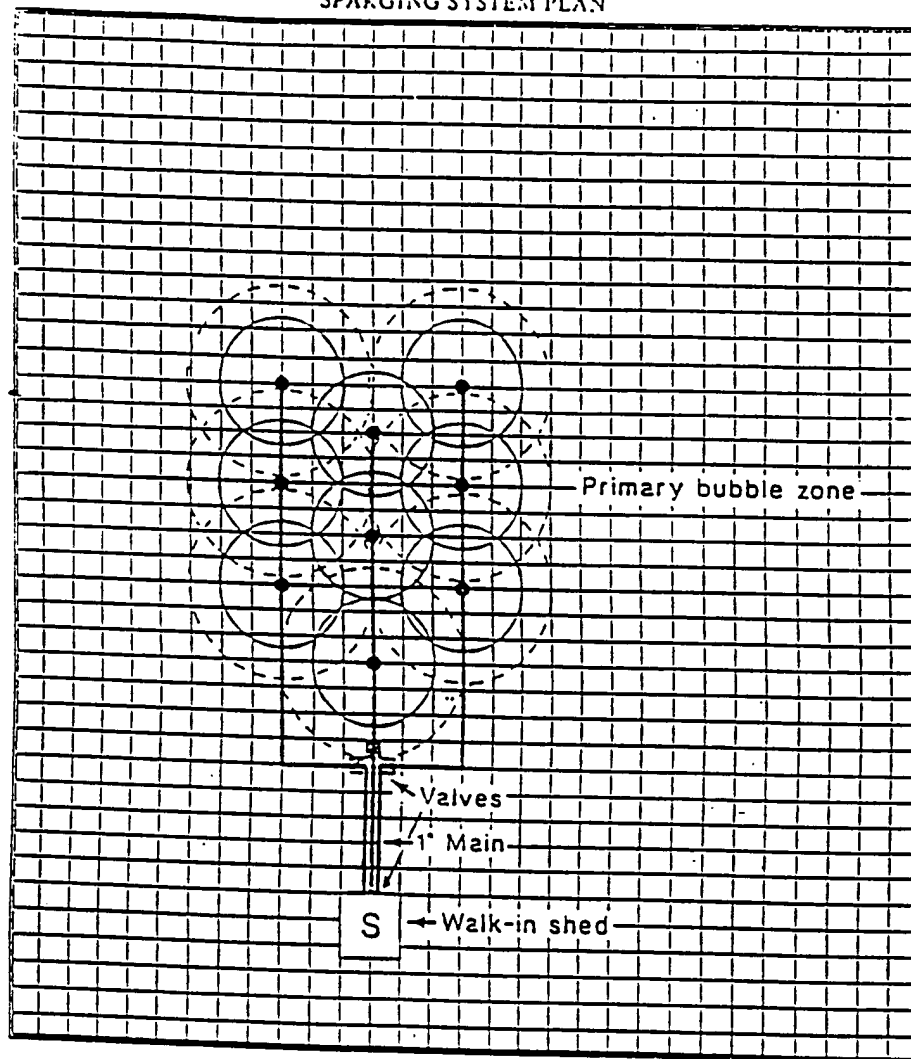


FIG. 16

1050 T 25 T 8550

SPARGING SYSTEM PLAN



Size of Sparge Area	<u>100 x 150 ft</u>	Size of SVE Area	<u>150 x 200 ft</u>
Use of Zone Control?	<u>3 zones</u>	Size of SVE System	<u>150 scfm</u>
Number of Spargepoints™	<u>9</u>	Depth to Water	<u>10 ft</u>
Soil Conditions	<u>MEDIUM SAND</u>	Type of Contaminant	<u>BTEX</u>

FIG. 17

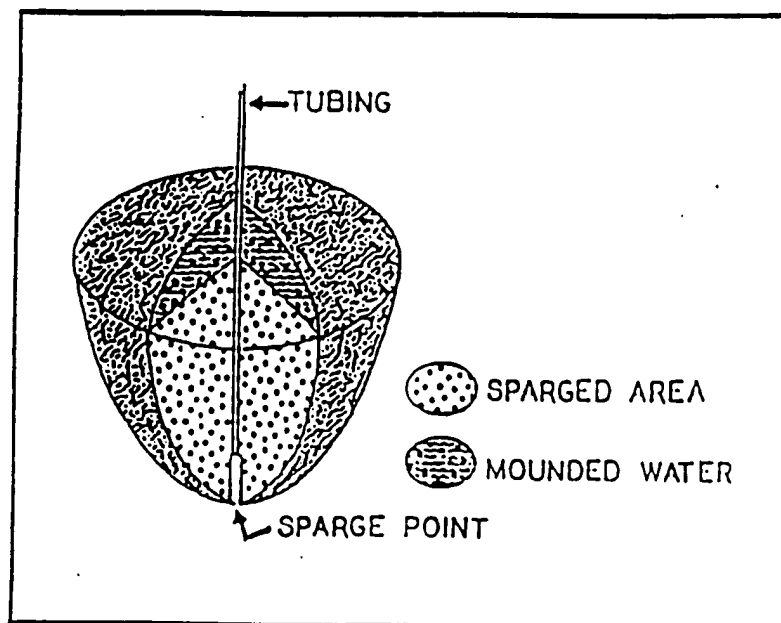


FIG. 18

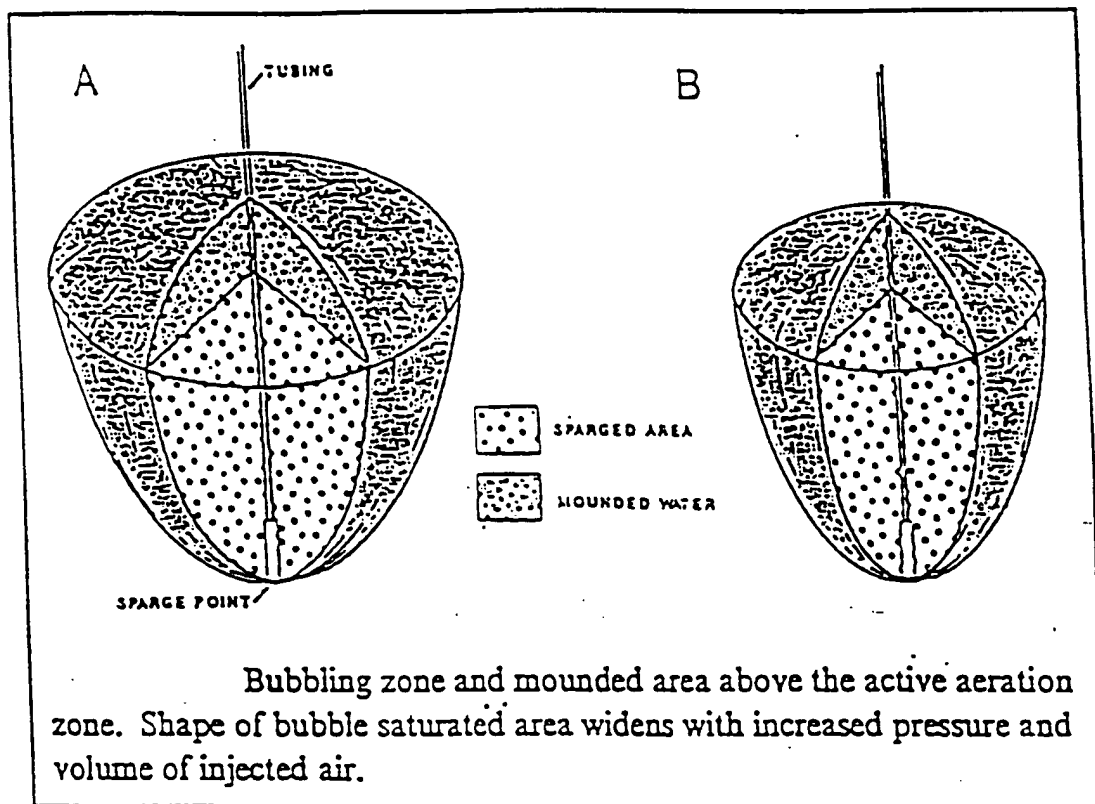


FIG. 19

FOOT - 257E660

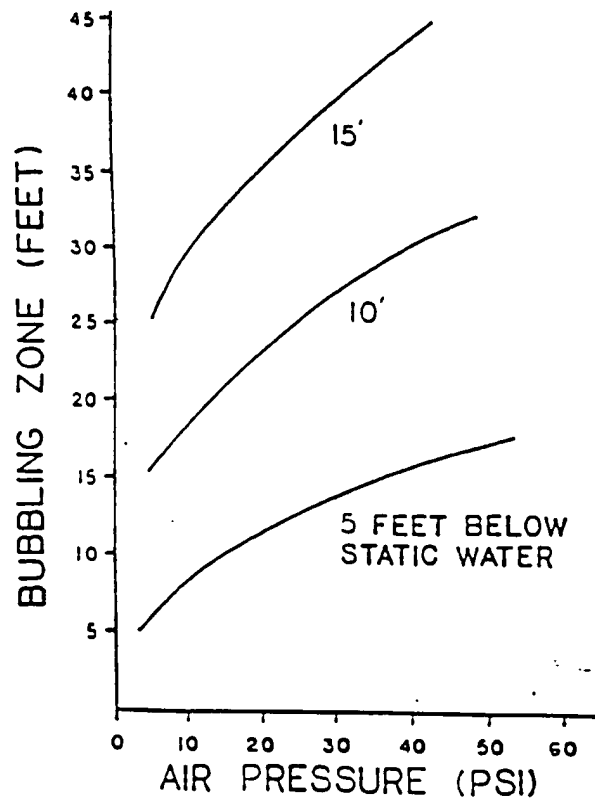


FIG. 20

Sequential rise in water table from bubbling. Concentric zones permit containing Any floating contaminant.

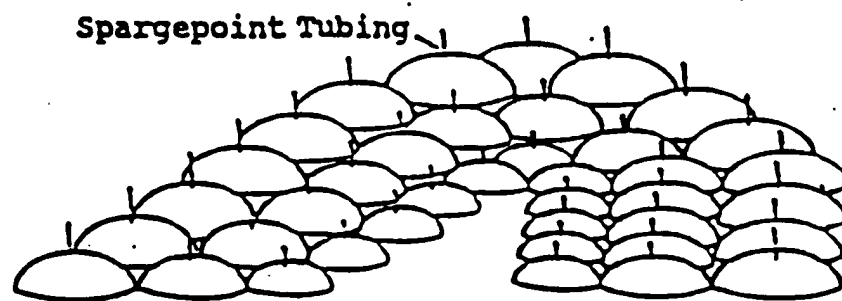


FIG. 21

Sequential rise in water table from bubbling. Concentric zones permit containing any floating contaminant.

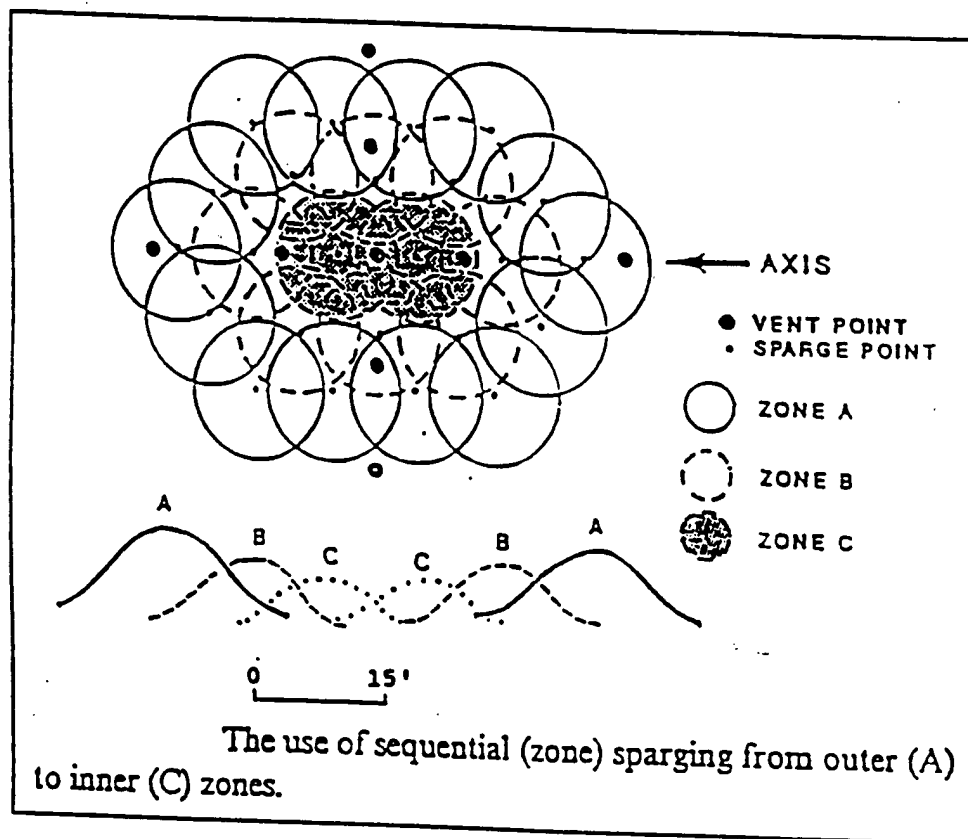


FIG. 22

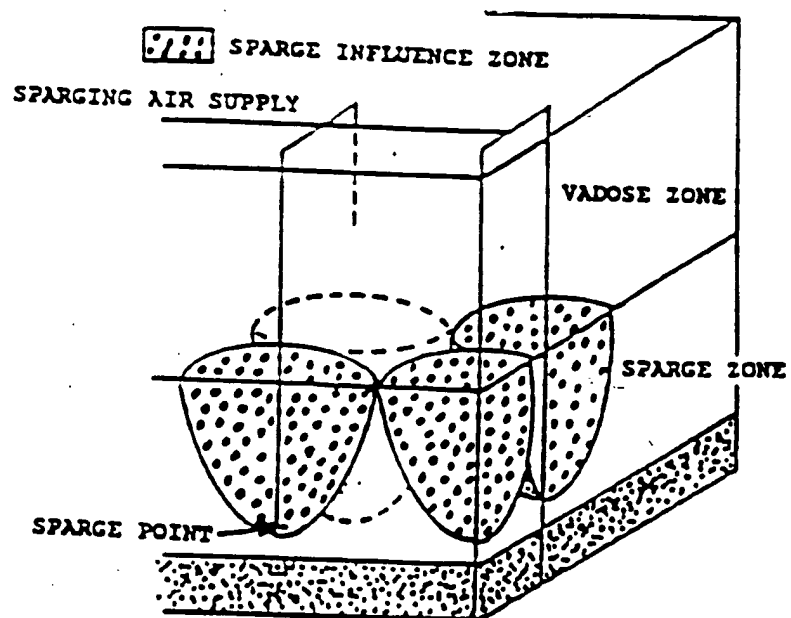


FIG. 23A

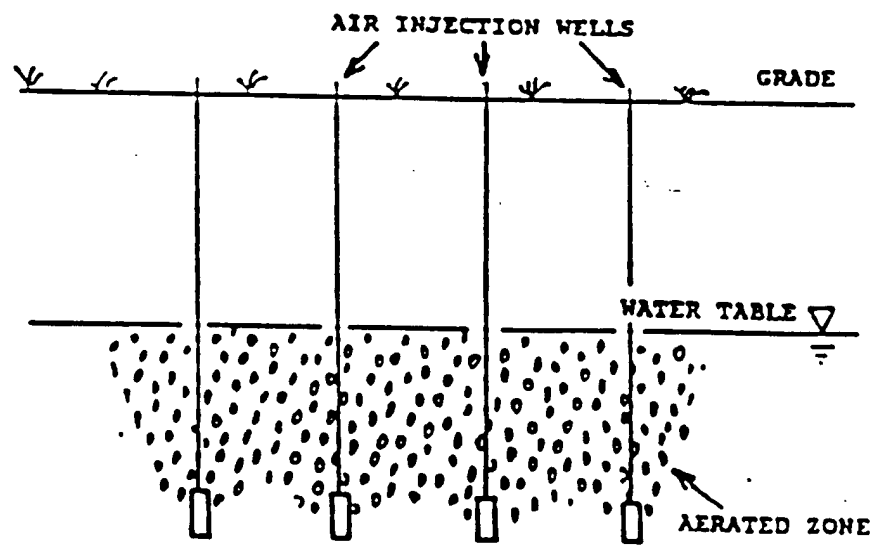


FIG. 23B

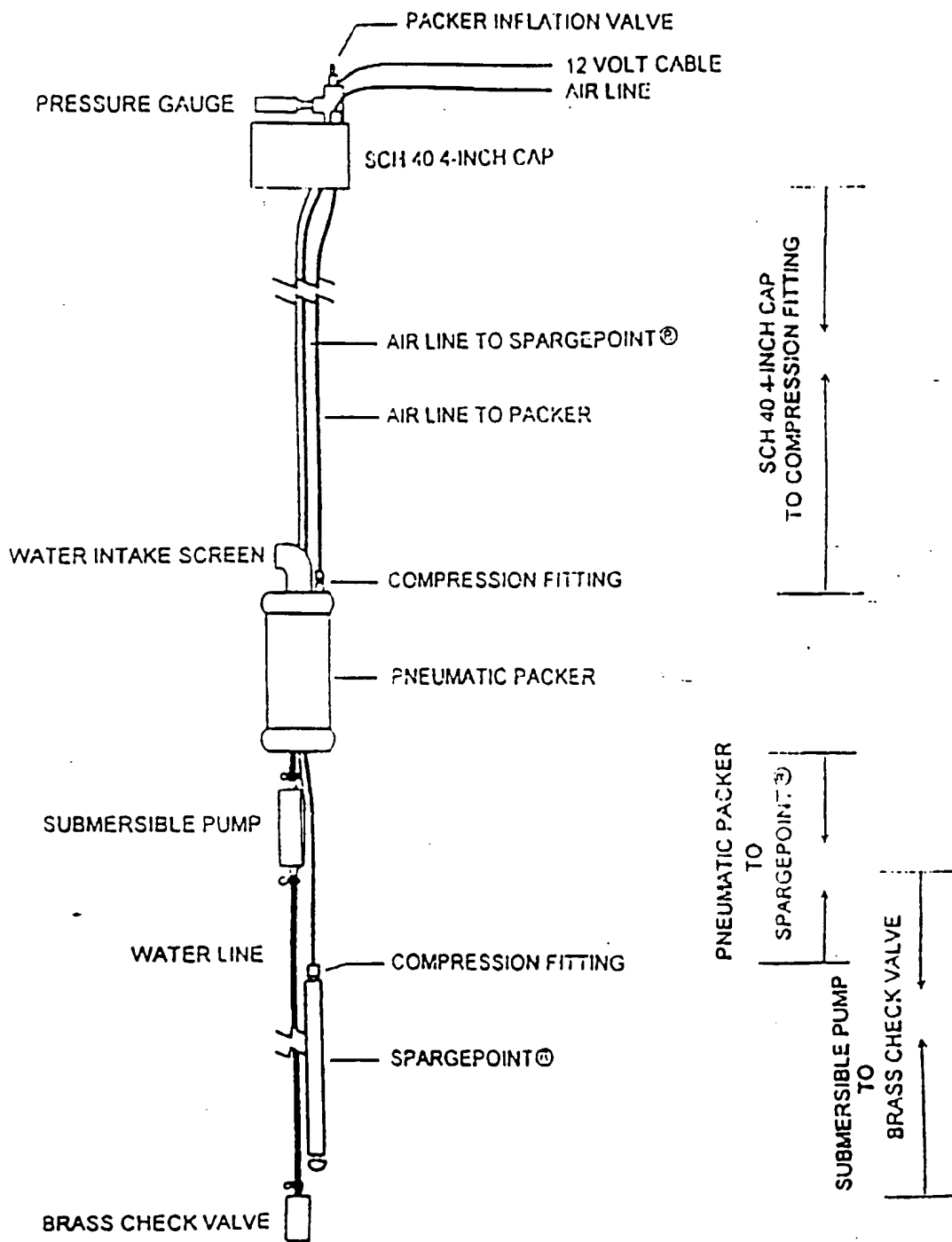


FIG. 25

FIG. 26

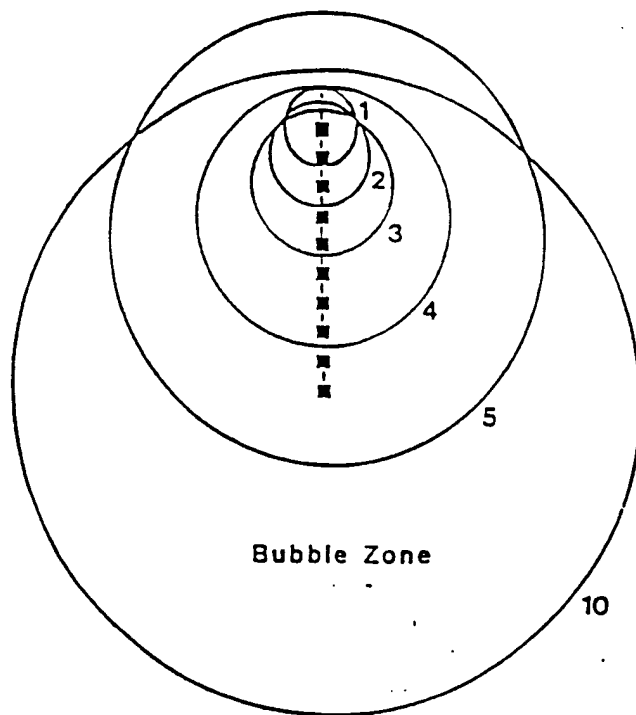


FIG. 26

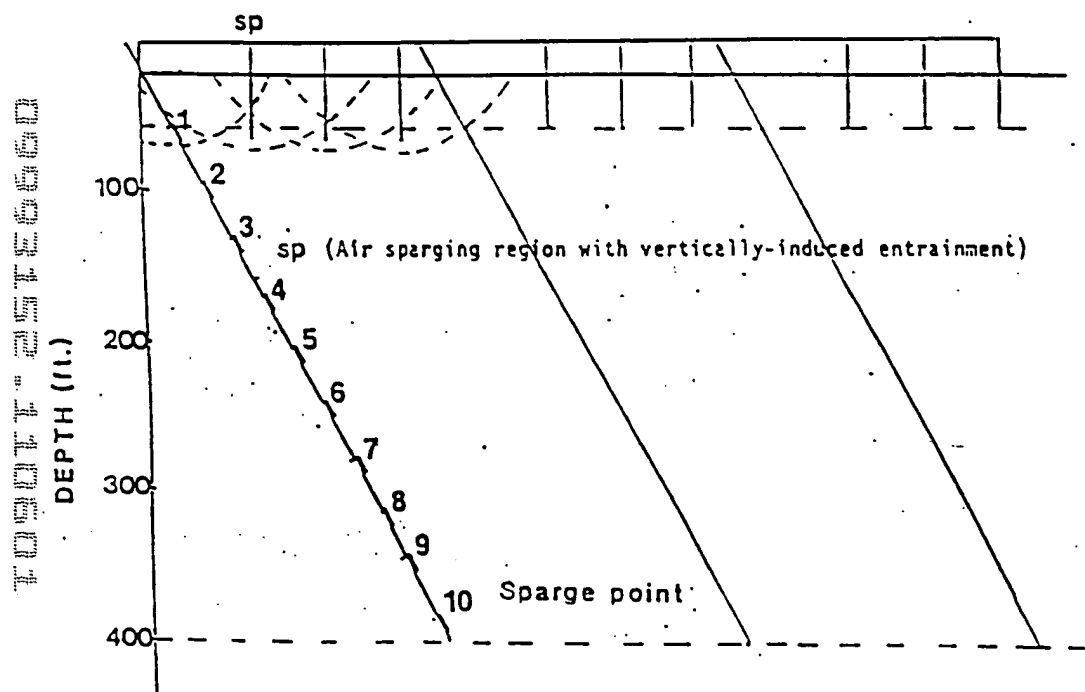


FIG. 27

REPORT 25 FEB 60

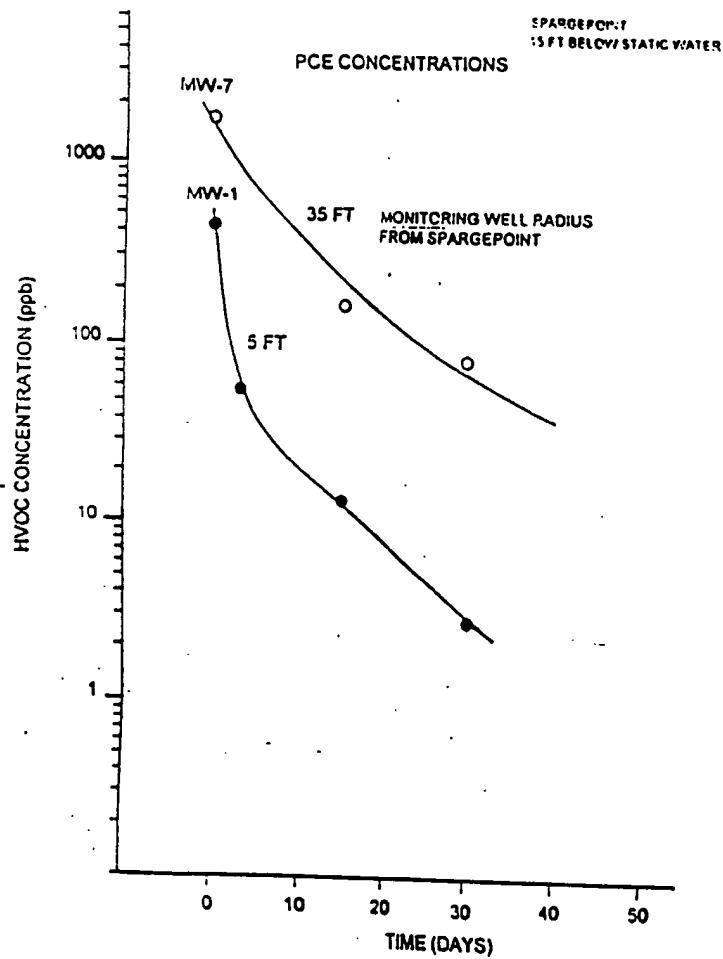


FIG. 28

FOOTING 25T6660

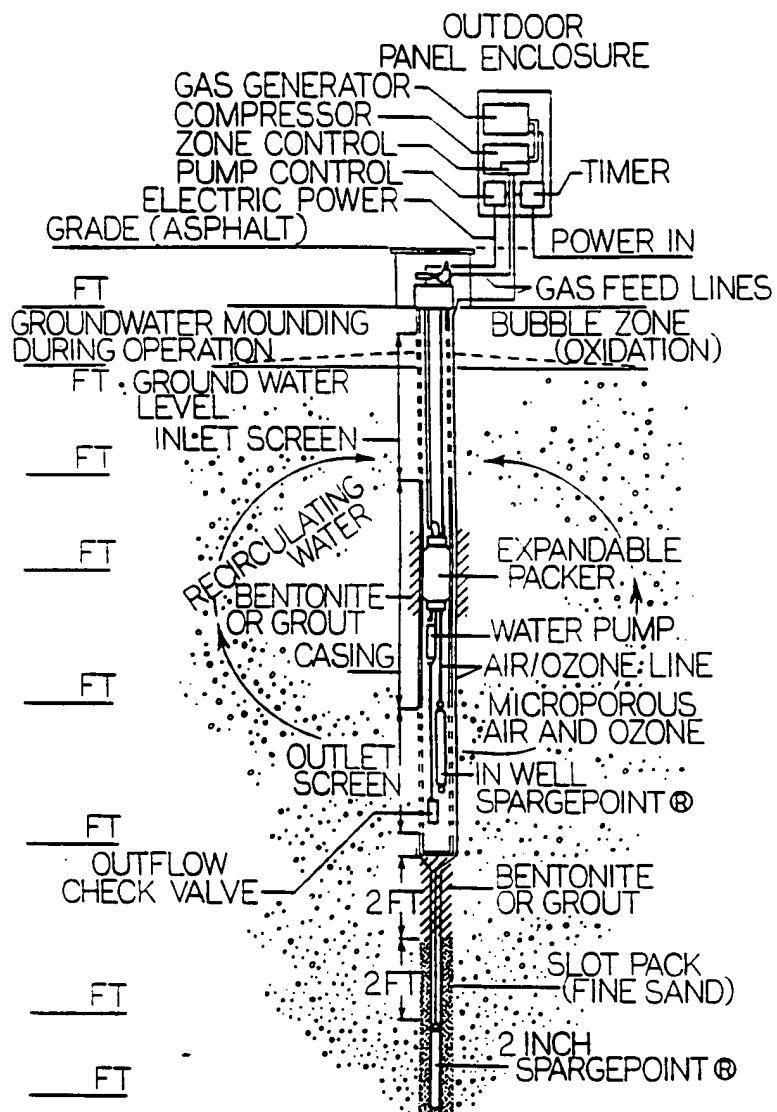
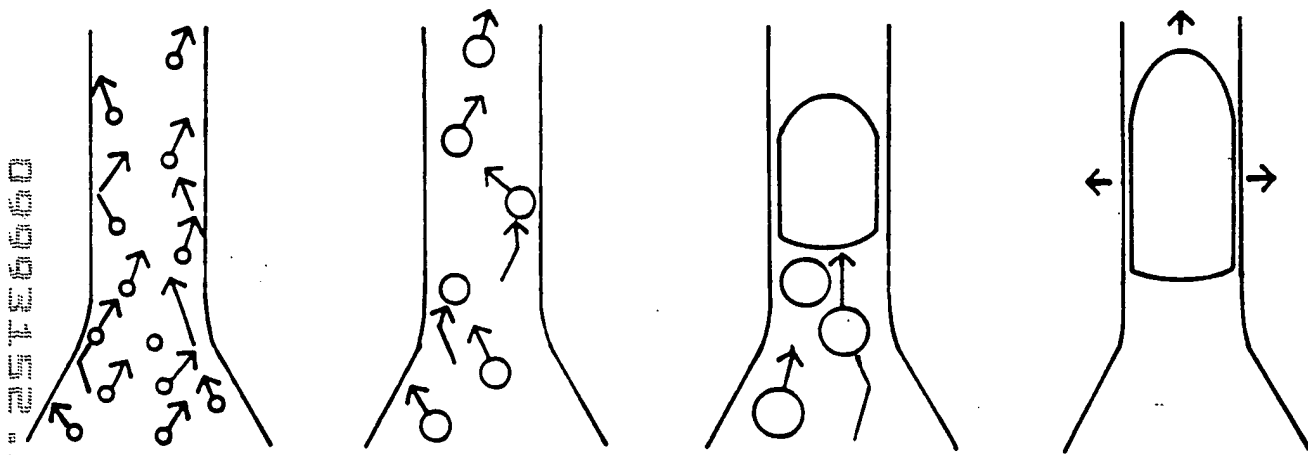


FIG. 29



Movement of microbubbles through saturated pores as diameter of bubble increases, showing coalescing.

FIG. 30

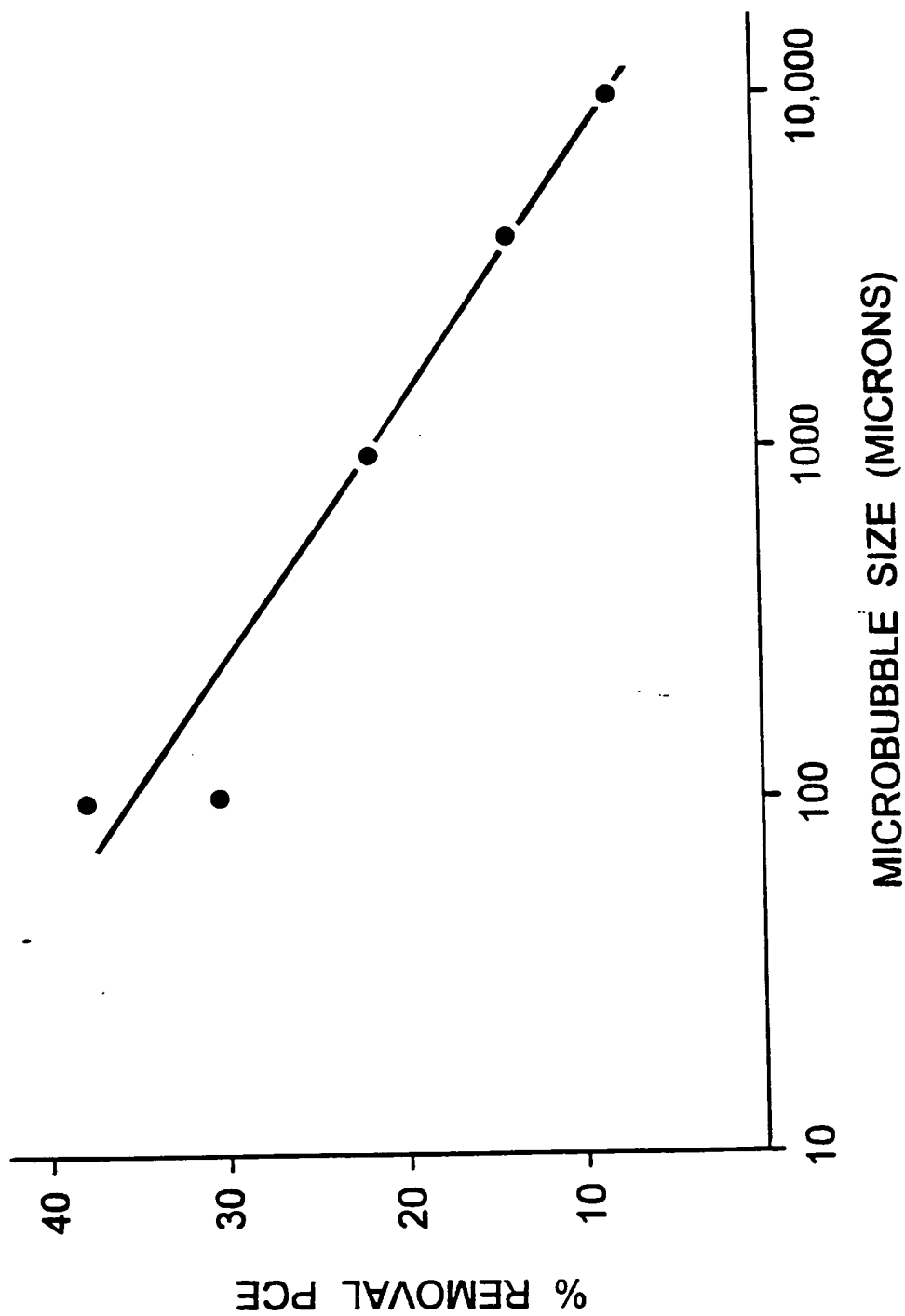


FIG. 31

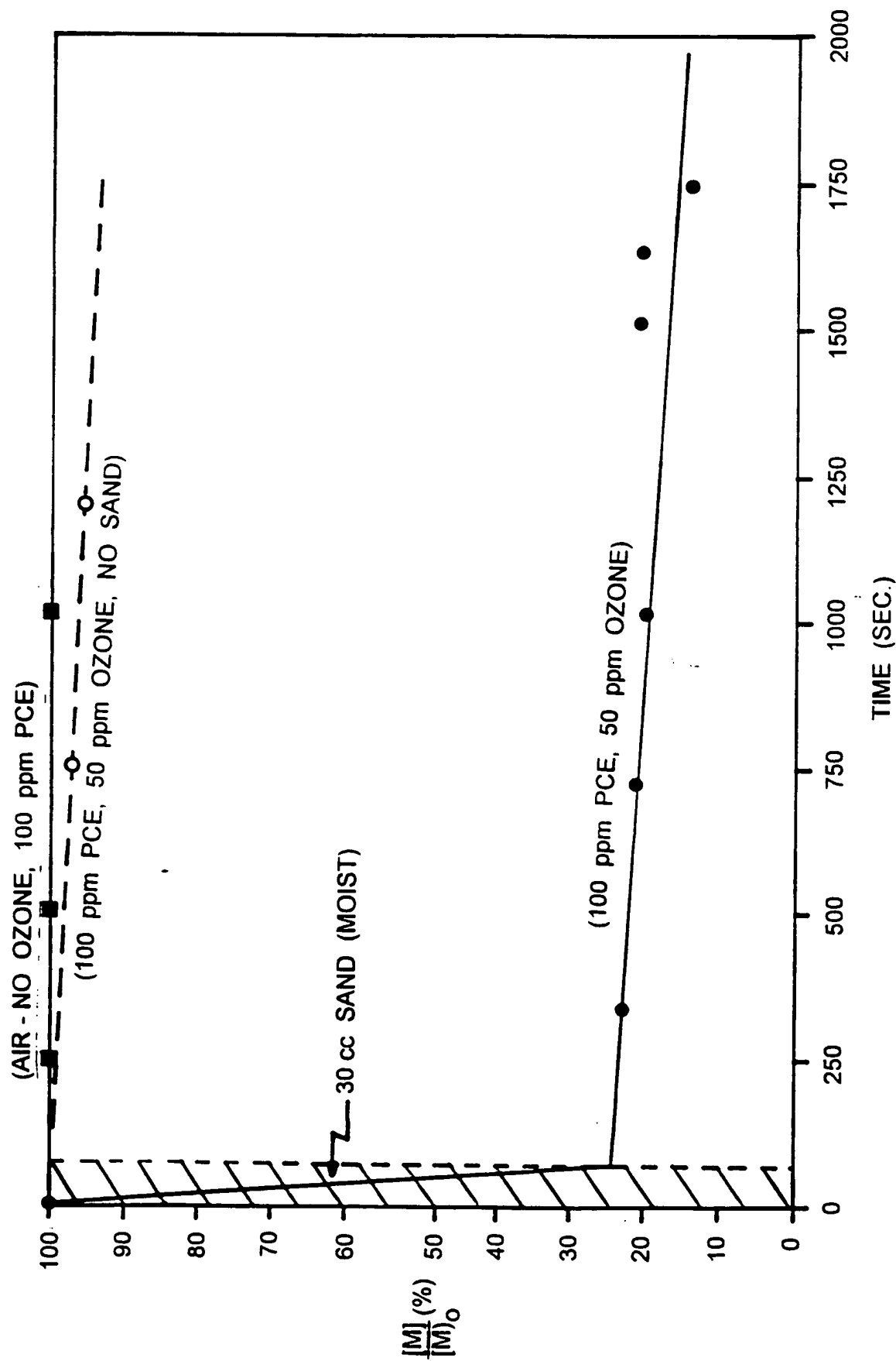


FIG. 32

OZONE AQUEOUS REACTIONS

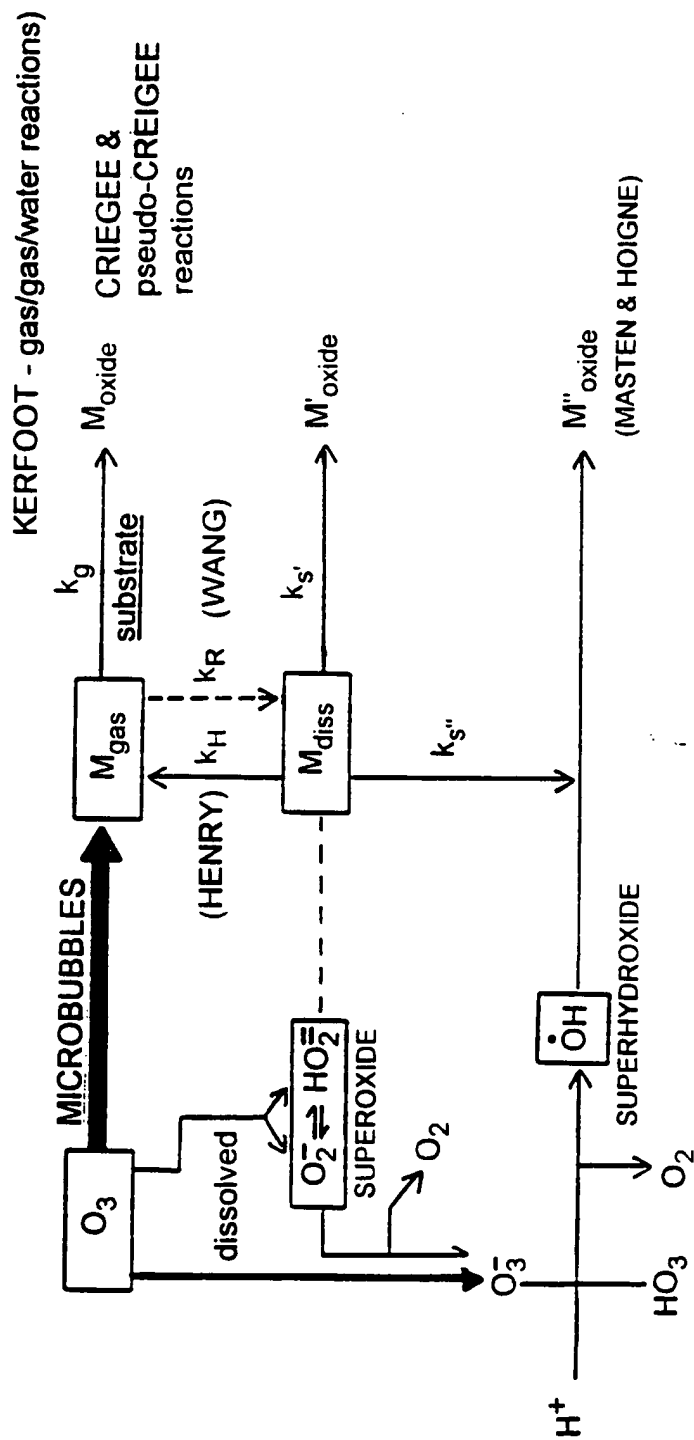


FIG. 33

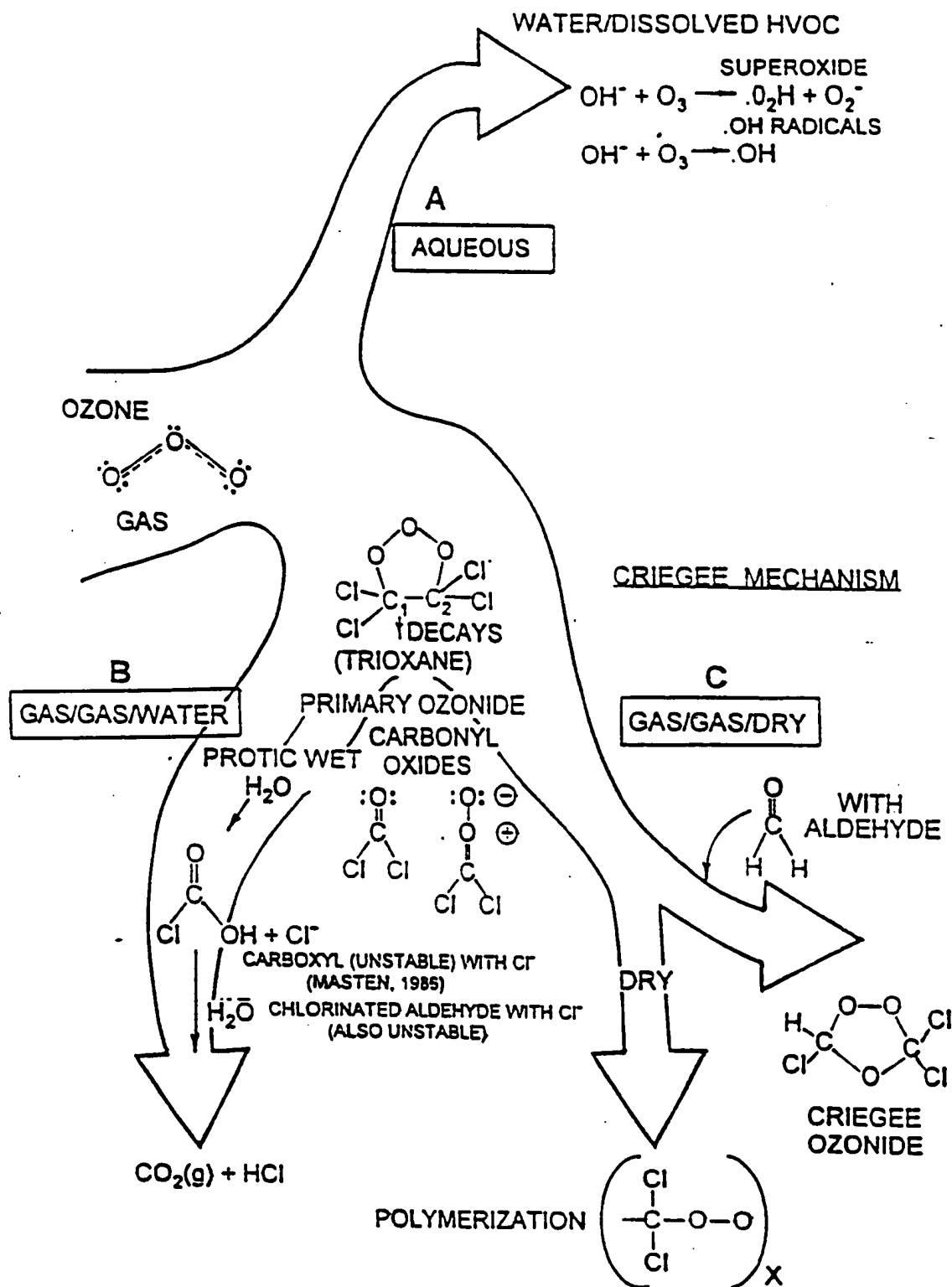


FIG. 34

MICROBUBBLE GENERATOR COLUMN CHAMBER

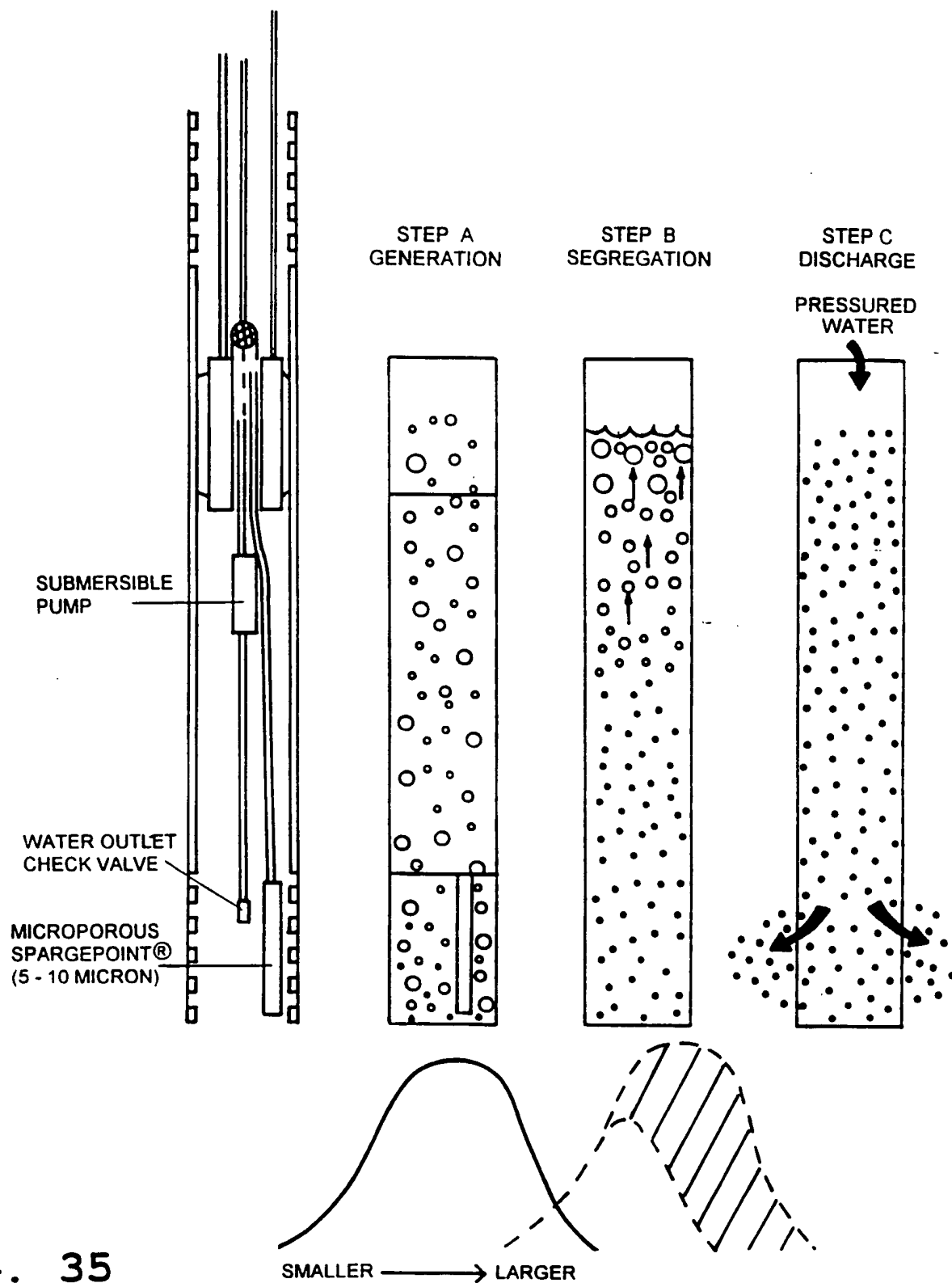


FIG. 35

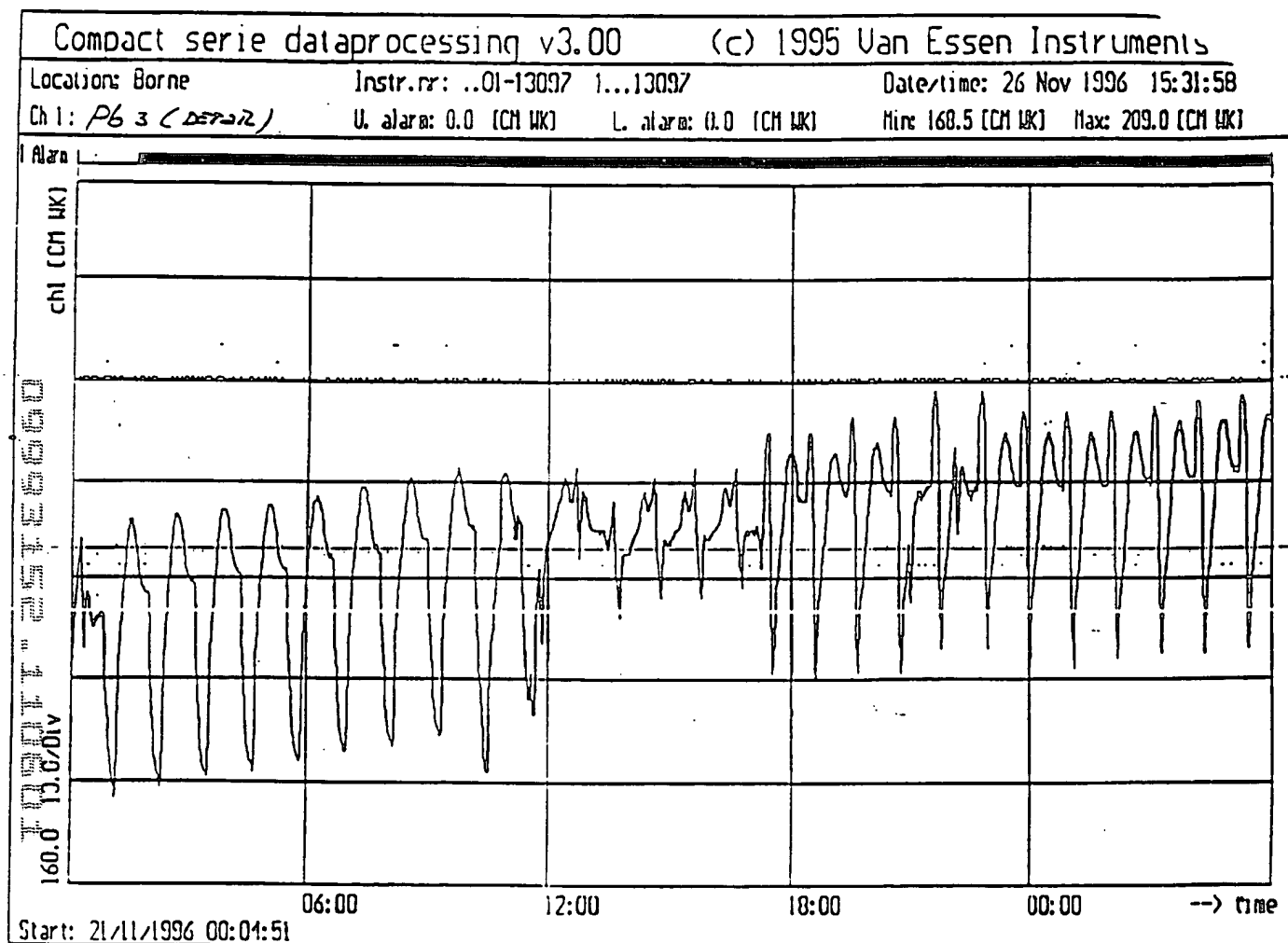


FIG. 36

10907-2575550

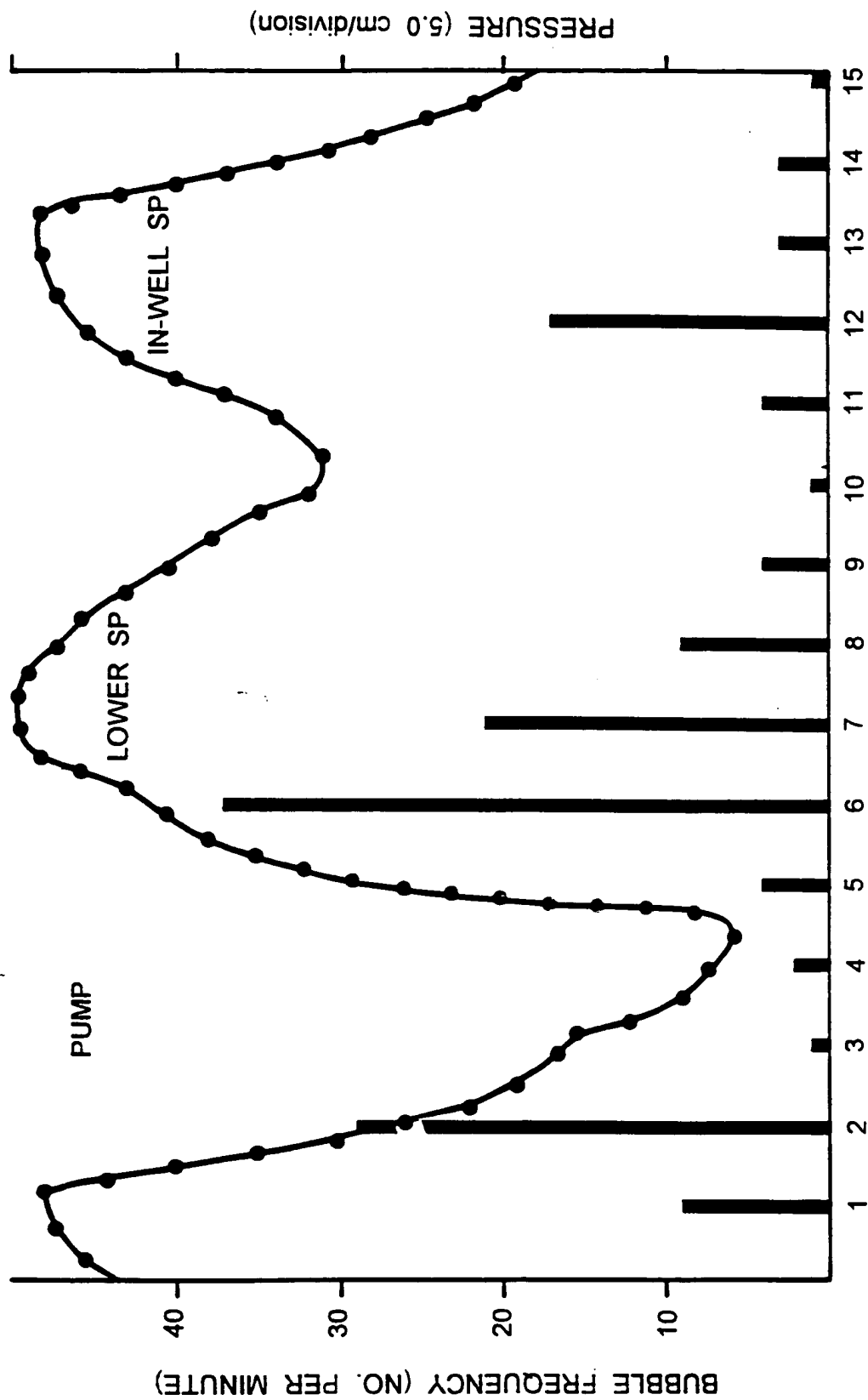


FIG. 37

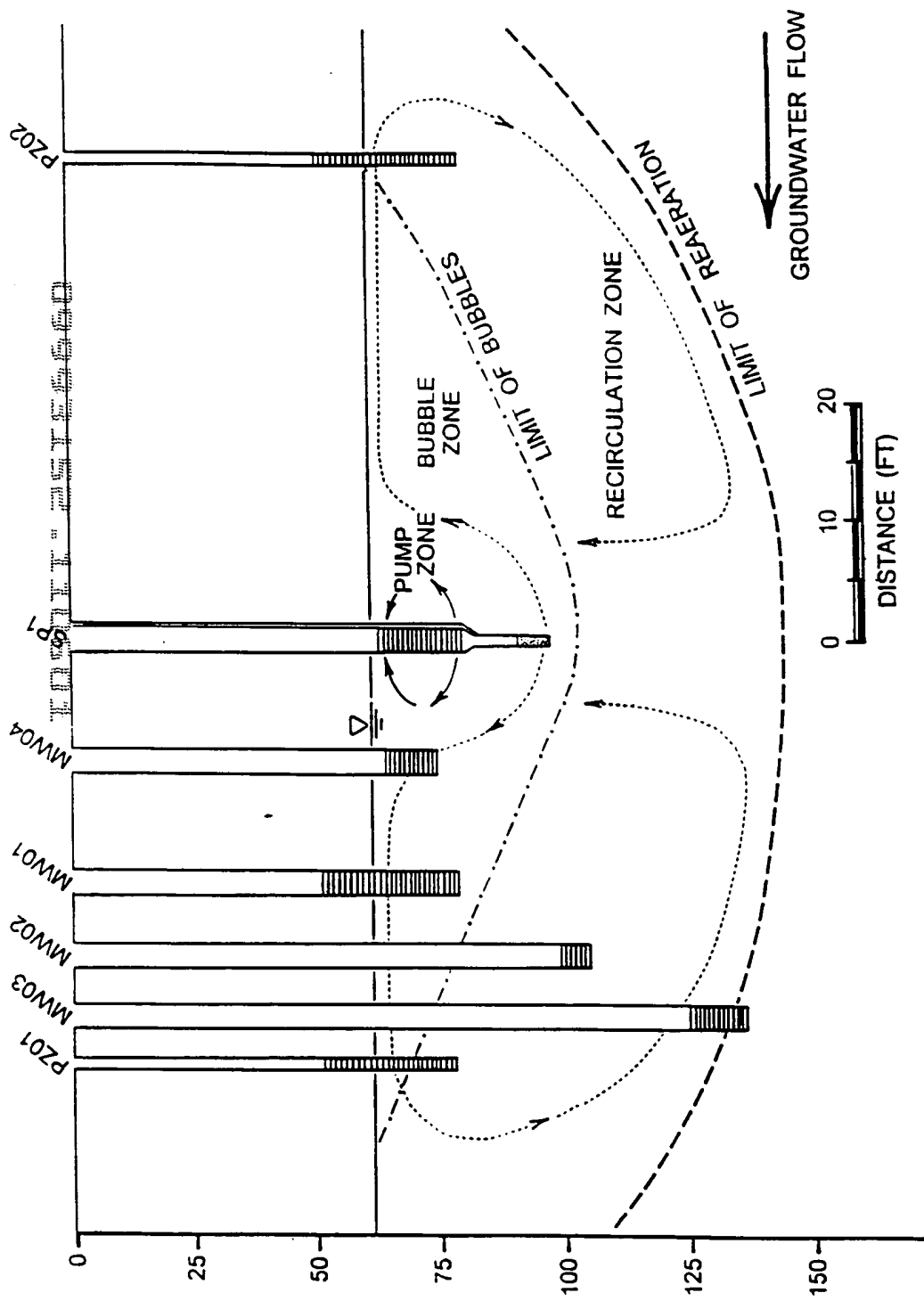


FIG. 38

FOOT 2512500

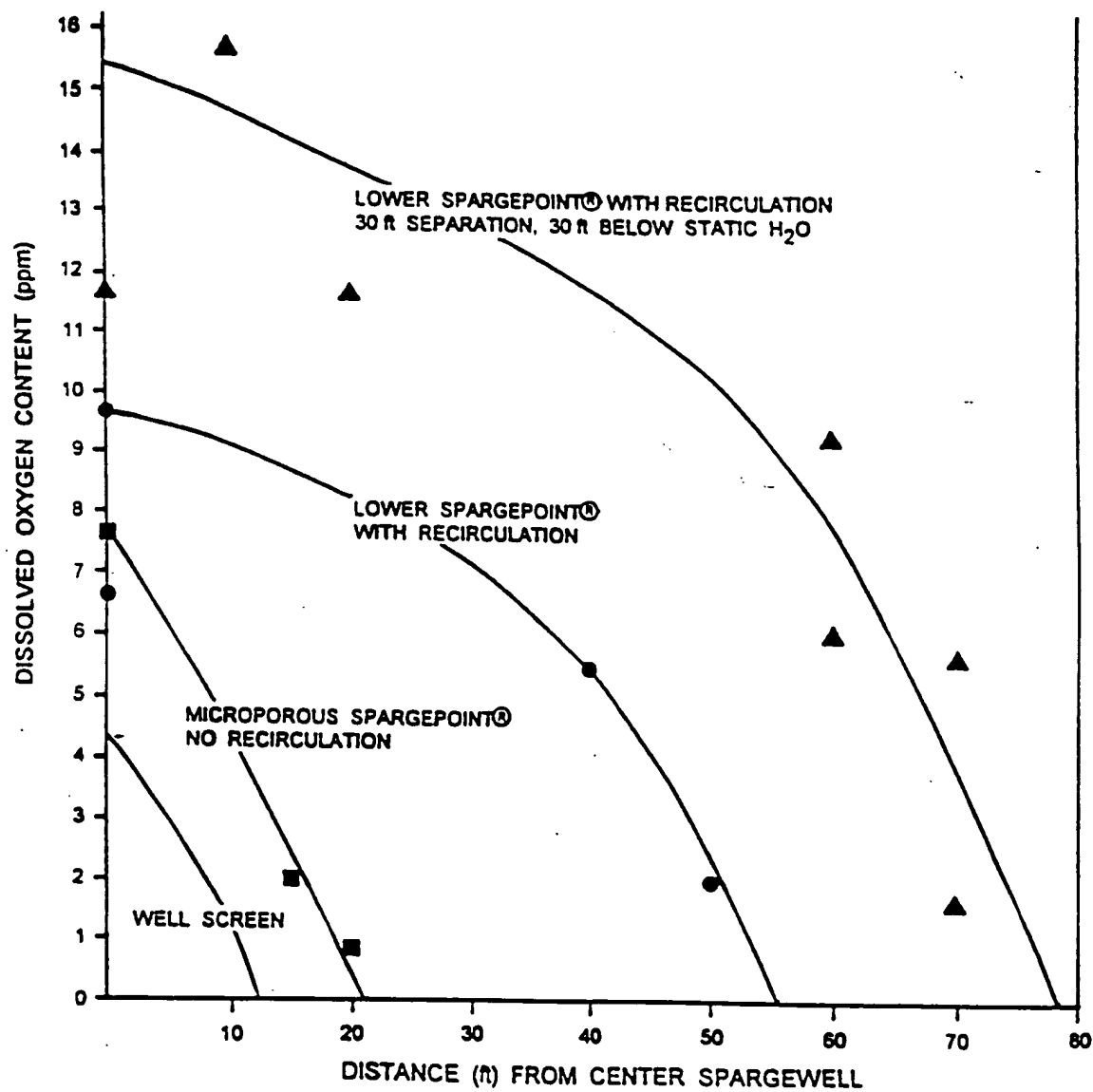


FIG. 39

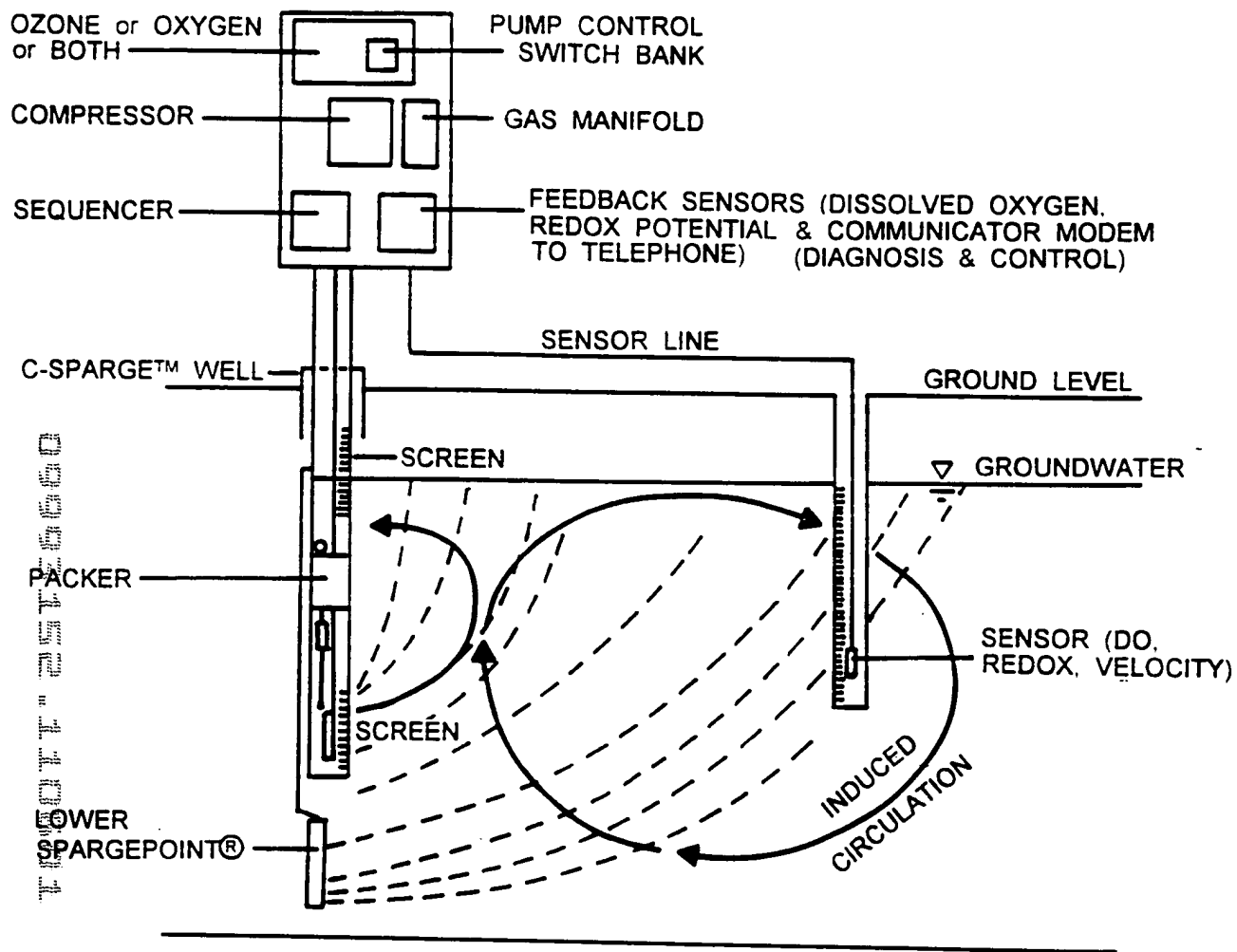


FIG. 40